

What is claimed is:

1. A color shift correcting method for correcting a color shift due to misregistration of images in different colors, where a multi-color image is formed by developing latent one-color images written onto respective image carriers by an optical writing device, and directly or indirectly transferring developed one-color images onto a movable element, said method comprising the step of:

adjusting a position at which one of said image carriers is irradiated with an optical beam in a sub-scanning direction to correct said color shift while said optical beam is irradiated from said optical writing device onto said image carriers to develop the latent one-color images.

2. The color shift correcting method according to claim 1, wherein said step of adjusting includes reading a pattern written on said image carriers before starting the adjustment for detecting, to detect the color shift among the developed one-color images, and adjusting the position at which the optical beam is irradiated based on the result of reading the pattern.

3. The color shift correcting method according to claim 2, further comprising:

setting a write timing at which said pattern is written based on a timing at which a reference point  
5 provided on one of said image carriers is detected.

4. The color shift correcting method according to claim 2, further comprising:

setting a write timing at which said pattern is  
10 written based on a timing at which a reference point provided on an intermediate transfer element is detected.

5. A color shift correcting method according to claim 1, wherein said step of adjusting includes the steps of:

15 correcting a write timing at which said optical writing device writes an image; and

correcting the position of the optical beam, and

wherein said step of correcting a writing timing and said step of correcting the position of the optical beam  
20 are executed concurrently.

6. A color shift correcting method according to claim 5, wherein:

said step of correcting the write timing includes

correcting a portion corresponding to a quotient derived by dividing an amount of misregistration by a dot pitch, and

said step of correcting the position of the optical  
5 beam includes correcting a portion corresponding to a residual resulting from the dividing of the amount of misregistration by the dot pitch.

7. An optical writing apparatus, comprising:

10 optical writing means for irradiating image carriers with optical beams based on input image information and for performing optical writing to form one-color images on each of said image carriers in a plurality of colors; and  
adjusting means for adjusting positions at which the  
15 optical beams are irradiated onto each of said image carriers, such that the positions match when the one-color images are superimposed.

8. The optical writing apparatus according to claim  
20 7, wherein:

said optical writing means includes a laser light emitting element and a coupling optical system, and

said adjusting means comprises a holding member for integrally holding said laser light emitting element and

said coupling optical system, and a driving mechanism for moving said holding member in the sub-scanning direction.

9. The optical writing apparatus according to claim  
5 8, further comprising:

an optical housing for holding an optical deflector;  
and

other optics for irradiating said image carriers with  
an optical beam,

10 said holding member being supported in said optical  
housing for rotation about an axis such that said holding  
member is eccentric to an optical axis of the optical  
beam.

15 10. The optical writing apparatus according to claim  
9, wherein said driving mechanism drives said holding  
member for rotation about said axis.

11. The optical writing apparatus according to claim  
20 9, wherein said optical axis of the optical beam is  
eccentric to the axis of rotation of said holding member  
such that said optical axis of the optical beam matches  
said axis of rotation of said holding member at an optical  
beam deflecting position of said optical deflector.

12. An optical writing apparatus according to claim 8,  
wherein said holding member comprises guide members  
parallel with the sub-scanning direction of said image  
5 carriers in said optical housing, said holding member  
being supported for movement along said guide members.

13. An optical writing apparatus according to claim  
12, wherein said driving mechanism transports said holding  
10 member along said guide members.

14. An optical writing apparatus according to claim  
12, wherein said guide members have a curvature which is  
set such that the optical axis of the optical beam  
15 substantially matches an optical beam deflecting position  
of said optical deflector when the optical beam is moved.

15. An image forming apparatus comprising:  
at least one image forming means having an image  
20 carrier for forming images in different colors;  
a movable element for directly or indirectly receiving  
the images formed by said image forming means; and  
an optical writing apparatus including,  
optical writing means for irradiating image carriers

with optical beams based on input image information and  
for performing optical writing to form images in a  
plurality of colors, and

adjusting means for adjusting positions at which the  
5 optical beams are irradiated onto each of said image  
carriers, such that the positions match when the one-color  
images are superimposed.

16. The image forming apparatus according to claim  
10 15, further comprising:

color shift amount detecting means for detecting the  
amount of color shift based on a plurality of patterns  
formed on said movable element,

wherein said adjusting means makes an adjustment,  
15 based on the amount of color shift detected by said color  
shift amount detecting means, to correct a color shift.

17. The image forming apparatus according to claim  
15, further comprising:

20 a reference position mark provided for detecting a  
rotating phase of said image carrier;

detecting means for detecting said reference position  
mark; and

processing means for detecting an amount of color

shift on a color-by-color basis on said movable element based on a position at which said reference position mark is detected to calculate a color shift correction value corresponding to each of the different colors,

5        wherein said adjusting means adjusts a position at which the light beam is irradiated on an image carrier corresponding to one of the different colors, based on a detected reference position mark and a plurality of calculated color shift correction amounts, during  
10    formation of an image to correct the color shift.

18. The image forming apparatus according to claim 15, further comprising:

•        a reference position mark provided for detecting a  
15    rotating phase on said movable element;

      detecting means for detecting said reference position mark; and

      processing means for detecting an amount of color shift on a color-by-color basis on said movable element  
20    based on a position at which said reference position mark is detected to calculate a color shift correction value corresponding to each of the different colors,

      wherein said adjusting means adjusts a position at which the optical beam is irradiated on an image carrier

corresponding to one of the different colors, based on a detected reference position mark and a plurality of calculated color shift correction amounts, during formation of an image to correct the color shift.

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19. The image forming apparatus according to claim 17, wherein said adjusting means comprises:

a write timing control circuit for controlling a timing at which the optical beam is irradiated onto each image carrier based on the reference position mark on said image carrier and the plurality of calculated color shift correction values; and

a beam position control circuit for controlling a position at which the optical beam is irradiated.

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20. The image forming apparatus according to claim 19, wherein:

said write timing control circuit receives a quotient derived by dividing a misregistration amount by a dot pitch, and modulates a laser light emitting element based on the quotient, and

said beam position control circuit receives a residual resulting from the division of the misregistration amount by the dot pitch, and moves the optical housing based on



the residual.

21. The image forming apparatus according to claim 17, further comprising:

5        memory means for storing the plurality of color shift correction values; and

         reading means for reading the plurality of color shift correction values stored in said memory means.

10       22. An optical writing apparatus, comprising:

         an optical writing device configured to irradiate image carriers with optical beams based on input image information and for performing optical writing to form one-color images in a plurality of colors; and

15       an adjusting device configured to adjust positions at which the optical beams are irradiated onto each of said image carriers, such that the positions match when the one-color images are superimposed.

20       23. The optical writing apparatus according to claim 22, wherein

         said optical writing device includes a laser light emitting element and a coupling optical system, and

         said adjusting device comprises a holding member for

integrally holding said laser light emitting element and said coupling optical system, and a driving mechanism for moving said holding member in the sub-scanning direction.

5        24. The optical writing apparatus according to claim 23, further comprising:

an optical housing for holding an optical deflector;  
and

other optics for irradiating said image carriers with  
10 an optical beam,

said holding member being supported in said optical housing for rotation about an axis such that said holding member is eccentric to an optical axis of the optical beam.

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25. The optical writing apparatus according to claim 24, wherein said driving mechanism drives said holding member for rotation about said axis.

20        26. The optical writing apparatus according to claim 24, wherein said optical axis of the optical beam is eccentric to the axis of rotation of said holding member such that said optical axis of the optical beam matches said axis of rotation of said holding member at an optical

beam deflecting position of said optical deflector.

27. The optical writing apparatus according to claim  
23, wherein said holding member comprises guide members  
5 parallel with the sub-scanning direction of said image  
carriers in said optical housing, said holding member  
being supported for movement along said guide members.

28. The optical writing apparatus according to claim  
10 27, wherein said driving mechanism transports said holding  
member along said guide members.

29. The optical writing apparatus according to claim  
27, wherein said guide members have a curvature which is  
15 set such that the optical axis of the optical beam  
substantially matches an optical beam deflecting position  
of said optical deflector when the optical beam is moved.

30. An image forming apparatus comprising:  
20 an image forming device having an image carrier for  
forming images in different colors;  
a movable element configured to directly or indirectly  
receive the images formed by said image forming device;  
an optical writing apparatus including an optical

writing device for irradiating one-color image carriers with optical beams based on input image information and for performing optical writing to form images in a plurality of colors; and

5        an adjusting device configured to adjust positions at which the optical beams are irradiated onto each of said image carriers, such that the positions match when the one-color images are superimposed.

10        31. The image forming apparatus according to claim 30, further comprising:

        a color shift amount detecting device configured to detect the amount of color shift based on a plurality of patterns formed on said movable element,

15        wherein said adjusting device makes an adjustment, based on the amount of color shift detected by said color shift amount detecting device, to correct a color shift.

        32. The image forming apparatus according to claim 20 30, further comprising:

        a reference position mark provided for detecting a rotating phase of said image carrier;

        a detecting device configured to detect said reference position mark; and

a processing device configured to detect an amount of color shift on a color-by-color basis on said movable element based on a position at which said reference position mark is detected to calculate a color shift correction value corresponding to each of the different colors,

wherein said adjusting device adjusts a position at which the light beam is irradiated on an image carrier corresponding to one of the different colors, based on a detected reference position mark and a plurality of calculated color shift correction amounts, during formation of an image to correct the color shift.

33. The image forming apparatus according to claim 30, further comprising:

a reference position mark provided for detecting a rotating phase on said movable element;

a detecting device configured to detect said reference position mark; and

a processing device configured to detect an amount of color shift on a color-by-color basis on said movable element based on a position at which said reference position mark is detected to calculate a color shift correction value corresponding to each of the different

colors,

wherein said adjusting device adjusts a position at which the optical beam is irradiated on an image carrier corresponding to one of the different colors, based on a  
5 detected reference position mark and a plurality of calculated color shift correction amounts, during formation of an image to correct the color shift.

34. The image forming apparatus according to claim  
10 32, wherein said adjusting device comprises:

a write timing control circuit for controlling a timing at which the optical beam is irradiated onto each image carrier based on the reference position mark on said image carrier and the plurality of calculated color shift  
15 correction values; and

a beam position control circuit for controlling a position at which the optical beam is irradiated.

35. The image forming apparatus according to claim  
20 34, wherein

said write timing control circuit receives a quotient derived by dividing a misregistration amount by a dot pitch, and modulates a laser light emitting element based on the quotient, and

said beam position control circuit receives a residual resulting from the division of the misregistration amount by the dot pitch, and moves the optical housing based on the residual.

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36. The image forming apparatus according to claim 32, further comprising:

a memory device configured to store the plurality of color shift correction values; and

10 a reading device configured to read the plurality of color shift correction values stored in said memory device.